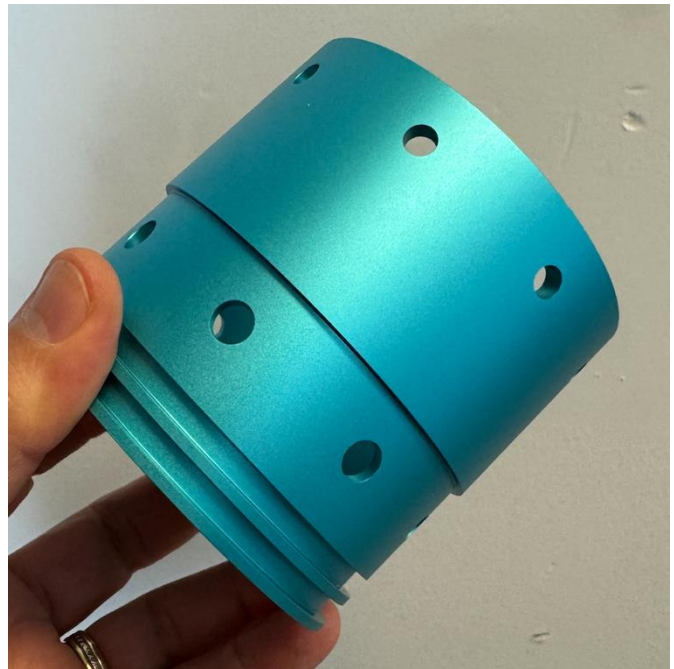
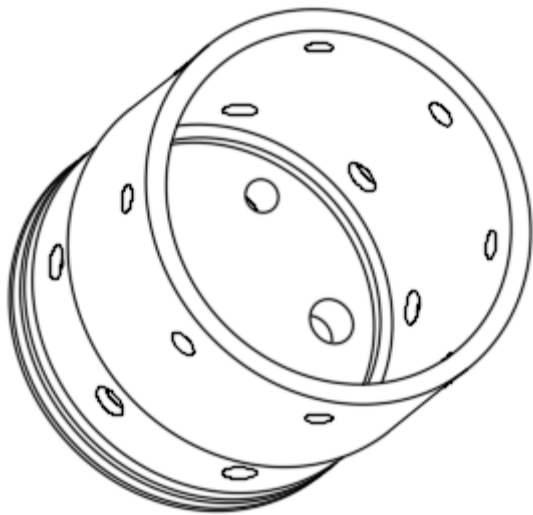


# HalfCat Mojave Sphinx Fuel Bulkhead Mod

Sinnoh Sphinx+ (SN05)  
Feb 1, 2025



# Overview and Background

The HC Mojave Sphinx works great exactly as designed in HCR-5100. It is battle tested with over 50 firings and flights.

After building, firing, and flying our Sinnoh Sphinx+ we noticed a small amount of IPA leaking from our fuel bulkhead when we went horizontal after filling and we noticed some small fuel leaks while pressurizing on the pad from camera footage post-flight. These leaks were minor and did not prevent the rocket from properly pressurizing, firing, or launching. The stock 4" aluminum tank tube and the +/- .013" ID tolerance is a wide variable, so we wanted to design a one-piece bulkhead with two o-rings to minimize the risk of a leak.

We also were not fond of the two recovery bulkhead posts and their gasket washers, so we redesigned the aft recovery anchor plate to not use the bolts. That freed up room in the fuel bulkhead, so we added a 1/8" NPT tube and small valve we could use to fill fuel after the bulkhead had been secured to the tank. This allows us to assemble the piston and fuel bulkhead at home and then "load and go" on the range.

## Special Considerations

This mod, as designed, will only work if you are using a standard 4" fiberglass airframe for your recovery section. That was an upgrade in our original build. The stock Mojave Sphinx uses a cardboard recovery airframe that cannot support the snap forces of the drogue with the relocated aft recovery bulkhead (anchor).

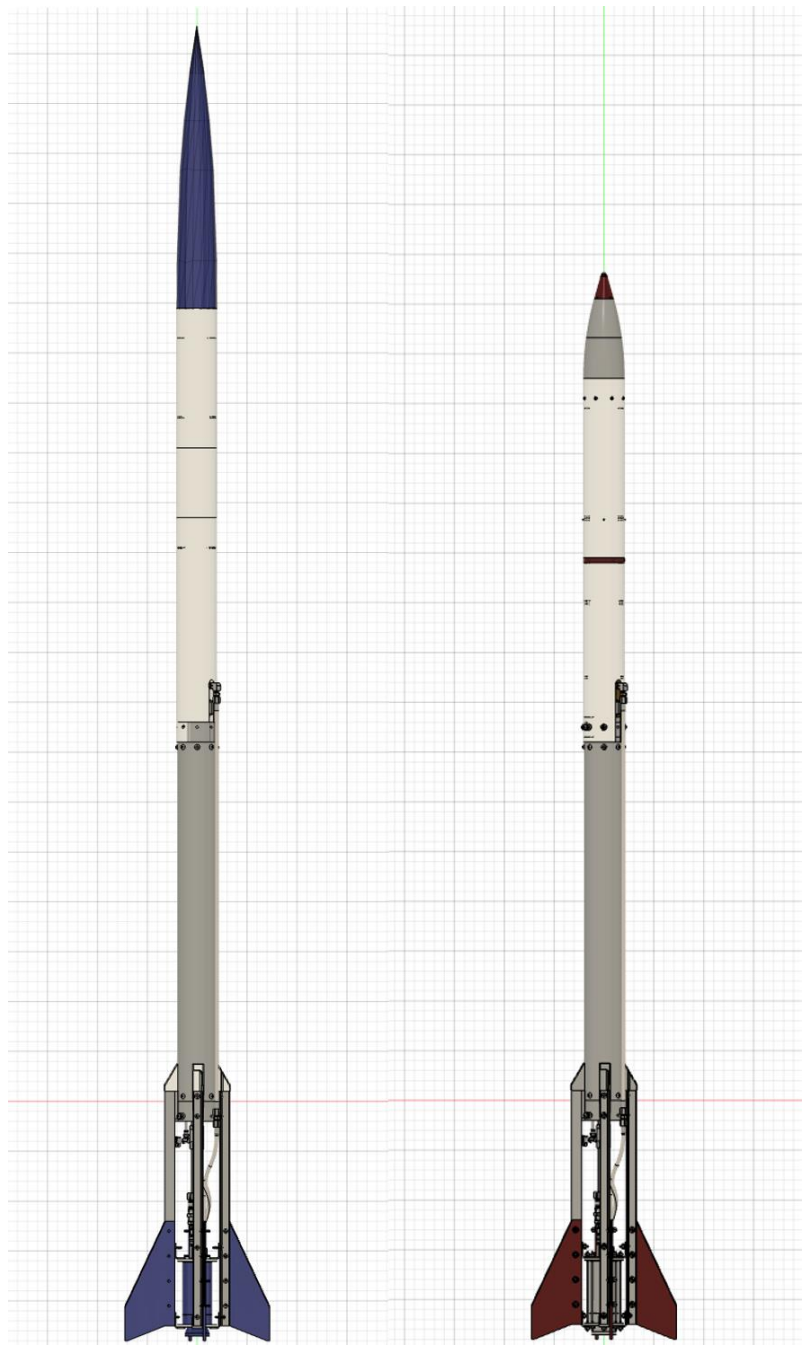
Mike & Preston

@RocketTalk33 on the HC Discord

# Recovery Considerations

Our MS is using standard 4" rocketry fiberglass for the recovery airframe, along with standard 4" fiberglass coupler for the AvBay and a fiberglass nose cone. Ours is slightly oversized to provide for a larger avBay (flight computers) and larger parachutes.

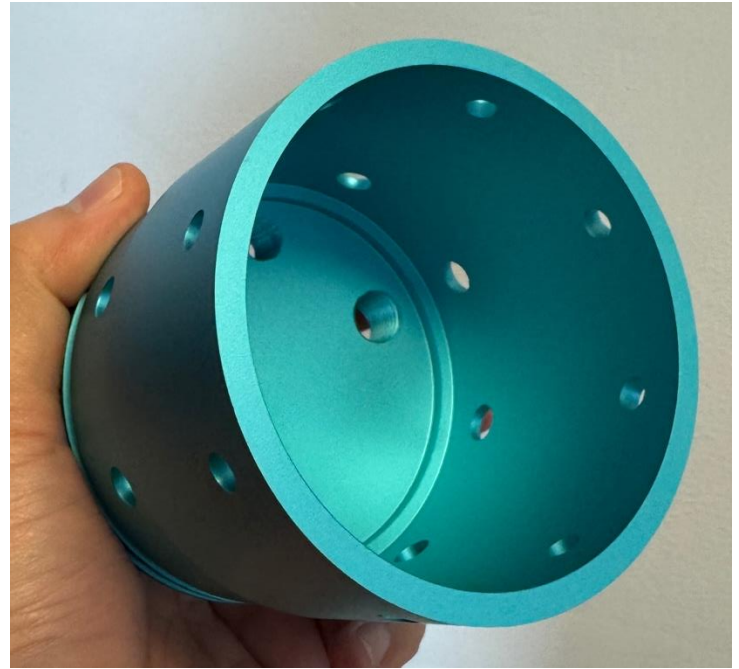
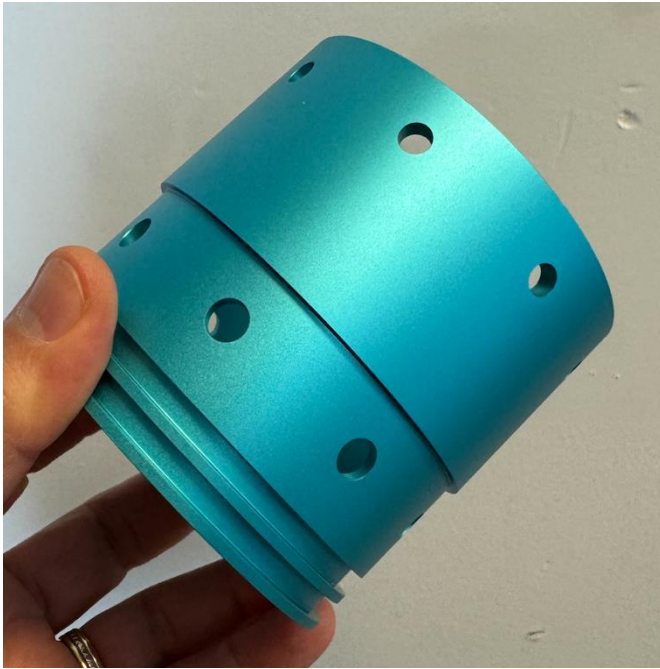
This mod design and the step files assume standard composite airframes, which can be acquired from many vendors online (e.g., Wildman Rocketry or Mad Cow).



Sinnoh Sphinx+  
(Fiberglass Recovery)

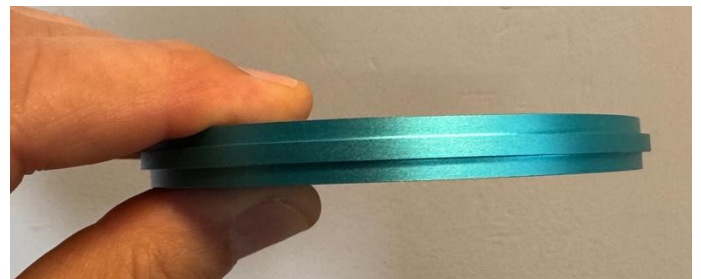
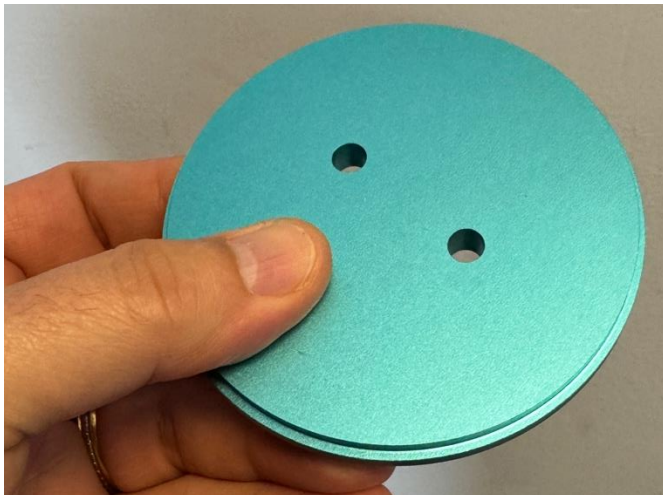
Mojave Sphinx

# Component Photos



This is our new single piece double o-ring fuel bulkhead. It is much more stable than the two piece, but it requires a large solid round and a lot of machining to cut it down (or \$76 to the kids in China). It is also slightly longer than the single o-ring design.

This is our new recovery bulkhead. It “floats” between two pieces of fiberglass coupler, inside the recovery airframe, so it is notched out on top and bottom. The forward piece of couple is epoxied into the airframe (along with two 5mm PEM nuts) providing forward retention and a floating piece of coupler is used aft of the bulkhead to provide reverse retention (pyro stops). This puts all the recovery snap forces onto the lower section of the fiberglass airframe, which is bolted into the tank.





# Assembly Photos



Assembled showing fuel valve and our new “fuel fill” port/valve.

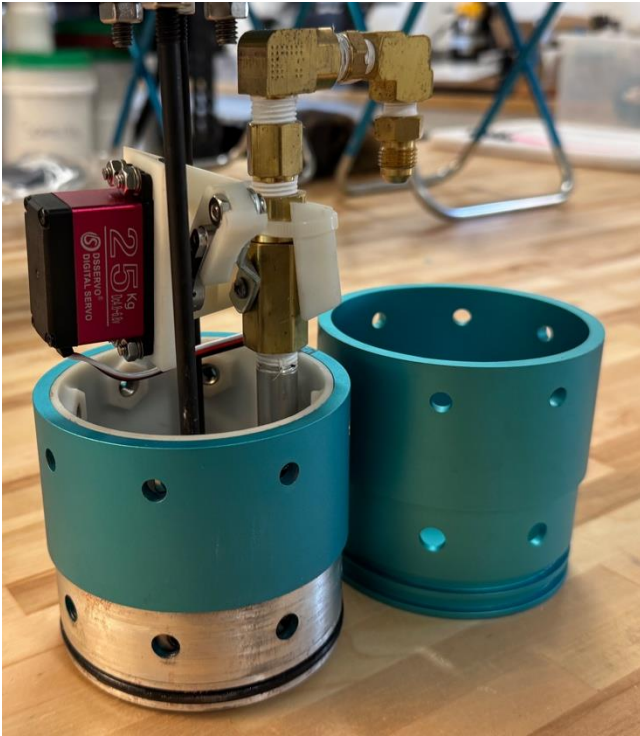


A handy funnel with a threaded nipple to connect for fast fueling when the bulkhead is already secured to the tank. This also allows us to “top off the tank”.

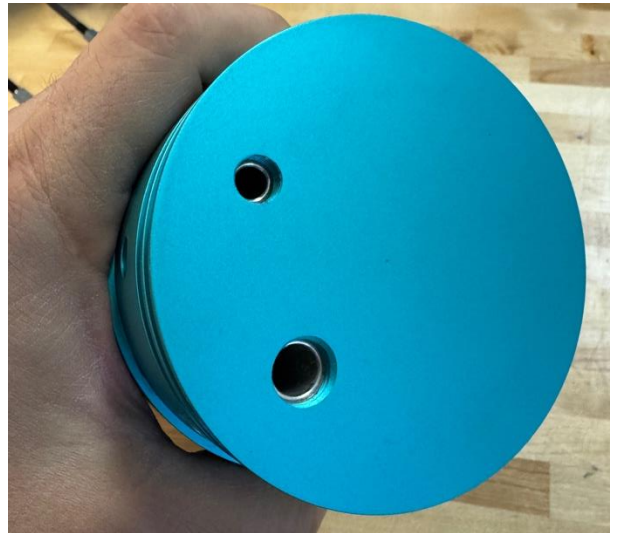
Note that this mod is designed to **use the standard** fuel valve, plumbing, servo, o-rings, and nut ring in the exact same position.

The fuel fill valve is a 1/8” x 5” NPT threaded tube and a 1/8” ball valve.

# Assembly Photos



The fuel bulkhead mod is only 1/8" longer, since it does not have any bolts/washers on the bottom.



Since the new bulkhead is flush on the bottom we shaved down the bump on the piston to squeeze out a bit more fuel.



# Assembly Photos



The four components of this mod include:

1. The new fuel bulkhead (machined)
2. The new recovery bulkhead (machined)
3. The forward fiberglass coupler stop (3" long - epoxied/screwed into the recovery airframe)
4. The aft fiberglass coupler stop (5" long – floating)

# Assembly Photos



This is a photo showing assembly, before the forward stop was glued into the airframe



With recovery airframe covering



# Assembly Photos



The 3" long piece of 4" fiberglass coupler is epoxied into the recovery airframe, such that the recovery bulkhead (anchor) sits tight with the aft coupler inserted and the airframe bolted to the tank. After the epoxy had dried we added two 5mm x 5mm bolts using four PEM nuts. This is a form of retention we have used on very large solid motor rockets. You likely could just use four nuts with PEM screws or just epoxy, but we double up ("belts and suspenders") when it comes to recovery.

To properly epoxy the coupler inside, do the following: 1) sand the ID of the airframe and the OD of the coupler 2) clean the surfaces well with IPA 3) use a high quality epoxy with a long cure time (we use Loctite Hysol EA E-20HP) 4) coat the inside of the airframe well around 8-10" from the aft end using your hands and a rubber glove 5) assemble the aft coupler stop, the recovery bulkhead and the forward coupler together on the tank (fuel bulkhead) 6) slide the airframe over and bolt onto the fuel bulkhead, such that the forward coupler is now in perfect position 7) let dry in a horizontal position, so epoxy doesn't drip down onto the recovery bulkhead.

# BOM

Here is a list of the non-standard stuff we used for this mod...

1. Machined fuel bulkhead (step file [here](#))
2. Machined recovery bulkhead (step file [here](#))
3. 4" standard rocketry fiberglass coupler (5" length & 3" length) ([Wildman](#))
4. Fuel fill valve
  1. 1/8" NPT x 5" aluminum pipe (44665K308)
  2. 1/4" NPT ball valve (McMaster 4112T12)
5. Epoxy – Loctite EA E-20HP
6. PEM nuts
  1. 5mm x 5mm hex screws (McMaster 92095A308)
  2. 5mm PEM nuts (McMaster 94674A606)